USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: An Optimal Rehabilitation - Design Model for a Reliable Water Distribution Network System

Duration: September 1, 1997 - August 31, 1999

Federal funds requested: $70,000

Non-federal (matching funds) pledged: $140,000

Principal Investigator(s) names and University:

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Congressional district: Ninth

Statement of critical regional or state water problems:

Virginia's cities are old and so are their water distribution systems. Pipes have become tuberculated, losing strength due to corrosion and are continually burdened with increasing demand. Having to face the public for raising required funds for watermain rehabilitation, municipalities are looking for efficient ways to reduce the financial burden by cost effective upgrades and by distributing the necessary expenses appropriately over time, so that judicious replacement and rehabilitation decisions can be implemented in some priority order without causing serious system outages. This task of upgrading water distribution systems has become a nationwide problem.

Municipalities can greatly benefit by a user friendly software that can guide them in making decisions on watermain design, rehabilitation and replacement. They are also interested in evaluating the system reliability under various scenarios involving multiple pipe breaks. At present, principally due to a lack of proper analytical tools, there is no software that can perform such a holistic water distribution system analysis.

Statement of Results or Benefits:

In this proposal, an integrated approach for the design, rehabilitation and time-phased budgeting of water distribution systems is presented. The approach combines the following four submodels. The first submodel identifies failure prone pipes; the second submodel assesses pipe network reliability during multiple breaks and valve failures; the third submodel optimally designs pipes for the expansion of an existing system, including rehabilitation and replacement decisions, and the fourth submodel prioritizes pipes needing rehabilitation or replacement in an optimal manner that is feasible to budgetary restrictions.

The proposed holistic approach integrates these submodels in a rolling horizon framework which enables the user to make comprehensive decisions dynamically over time. Although the methodology is sophisticated, it will be presented in a user-friendly, object-oriented environment. The user will be prompted and aided in data inputting and a well detailed, practice oriented output will be generated. The software will be structured upon consultation with the engineers at Roy F. Weston, Inc., an engineering m, as well as with Blacksburg and Roanoke municipal offices. The software will also be tested by practicing engineers.